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EXAMINER	
LERNER, MARTIN	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/688,950	Applicant(s) DENG ET AL.	
	Examiner Martin Lerner	Art Unit 2654	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 to 29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 to 29* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *4-7*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities:

On page 22, line 20, "FIG. 7" should be –FIG. 4—.

On page 24, lines 28 to 29, Applicants should insert the Serial Number of the U.S. Patent Application, as the Serial Number cannot be readily determined from the information provided.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 10, 11, and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by *Trompf ('968)*.

Regarding independent claim 1, *Trompf ('968)* discloses a method of training in speech recognition, comprising:

"introducing additive noise into a training signal, the additive noise being noise that is similar to noise that is anticipated to be present in a test signal during pattern recognition" – speech and noise are supplied to the speech recognition device by

microphone M (column 3, lines 13 to 15: Figure 1); a sequence of noisy vectors is supplied to the neural network N by the first preprocessor (PP1), which in turn receives summed speech-free noise signals from the microphone M and noise–free speech signal from memory S (column 4, lines 24 to 28: Figure 3); Figure 3 shows a training phase, where speech-free noise signals are combined with noise-free speech signals;

"applying at least one noise reduction technique to the training signal to produce pseudo-clean training data" – preprocessing installation PP1 is connected to neural network N, which performs the neural noise reduction (column 3, lines 19 to 21: Figure 1); a first neural noise reduction is performed by mapping the noisy vectors from the first preprocessor into noise-free vectors; thus, a noise-reduced vector is present at the output of the neural network, which can be noise-free in the ideal case (column 4, lines 28 to 32: Figure 3); the noise reduced vectors are "pseudo-clean training data" because the noise reduced vectors map noisy vectors to noise reduced vectors during the training phase of Figure 3, and the noise-reduced vectors only ideally approximate noise free vectors;

"constructing the pattern recognition model based on the pseudo-clean training data" – the neural network is trained to perform noise reduction to recognize speech in a noisy environment with the noise-free vectors and the noisy vectors; the noise-reduced value obtained with the iterative process is now considered trained into the neural network N (column 3, lines 49 to 64; column 5, lines 5 to 7: Figure 3); thus, the neural network is a "pattern recognition model" based on the noise-reduced vectors ("pseudo-clean training data").

Regarding independent claim 11, *Trompf ('968)* discloses training in speech recognition, comprising:

"identifying a type of noise that is expected to be present in a test signal from which a pattern is to be recognized" – a differentiation is made between noisy vectors Y, which are present in the neural network N at the time of the neural noise reduction, and noisy vectors X, which existed in the neural network at a previous point in time; in order to form conclusions about the future neural noise reduction of noisy vectors, all the previously mentioned information that could be drawn from the noise reduction is used to form conclusions about future noisy vectors Z (column 5, lines 10 to 32: Figure 2); implicitly, noisy vectors contain noise of the type represented by noisy vectors X and noisy vectors Y, which are vectors representing "a type of noise which is expected to be present in a test signal";

"generating a training signal such that the training signal contains the identified type of noise" – speech and noise are supplied to the speech recognition device by microphone M (column 3, lines 13 to 15: Figure 1); during training, a sequence of noisy vectors is supplied to the neural network by the first preprocessor (PP1) (column 4, lines 21 to 32: Figure 3);

"reducing the noise in the training signal to produce training data" – reprocessing installation PP1 is connected to neural network N, which performs the neural noise reduction (column 3, lines 19 to 21: Figure 1); during training a first neural noise reduction is performed by mapping the noisy vectors from the first preprocessor into

noise-free vectors; thus, a noise-reduced vector is present at the output of the neural network, which can be noise-free in the ideal case (column 4, lines 28 to 32: Figure 3);

"generating the model parameters based on the training data" – the neural network is trained to perform noise reduction to recognize speech in a noisy environment with the noise-free vectors and the noisy vectors; the noise-reduced value obtained with the iterative process is now considered trained into the neural network N (column 3, lines 49 to 64; column 5, lines 5 to 7: Figure 3); thus, the neural network contains "model parameters based on the training data".

Regarding independent claim 17, *Trompf ('968)* discloses a speech recognition system, comprising:

"a pattern recognition model having model parameters formed through a process comprising: generating a training signal such that the training signal includes a type of noise that is anticipated to be present in the test signal" – during speech recognition training, a sequence of noisy vectors is supplied to the neural network by the first preprocessor (PP1) (column 4, lines 21 to 32: Figure 3); the neural network is trained to have model parameters for speech recognition (column 5, lines 5 to 7); a differentiation is made between noisy vectors Y, which are present in the neural network N at the time of the neural noise reduction, and noisy vectors X, which existed in the neural network at a previous point in time; in order to form conclusions about the future neural noise reduction of noisy vectors, all the previously mentioned information that could be drawn from the noise reduction is used to form conclusions about future noisy vectors Z

(column 5, lines 10 to 32: Figure 2); implicitly, noisy vectors contain noise of the type represented by noisy vectors X and noisy vectors Y, which are vectors representing "a type of noise that is to be anticipated to be present in the test signal";

"reducing the noise in the training signal using a noise reduction technique to produce cleaned training values" – preprocessing installation PP1 is connected to neural network N, which performs the neural noise reduction (column 3, lines 19 to 21: Figure 1); a first neural noise reduction is performed by mapping the noisy vectors from the first preprocessor into noise-free vectors; thus, a noise-reduced vector is present at the output of the neural network, which can be noise-free in the ideal case (column 4, lines 28 to 32: Figure 3); the noise-free vectors are "cleaned training values";

"using the cleaned training values to form the model parameters" – the neural network is trained to perform noise reduction to recognize speech in a noisy environment with the noise-free vectors and the noisy vectors; the noise-reduced value obtained with the iterative process is now considered trained into the neural network N (column 3, lines 49 to 64; column 5, lines 5 to 7: Figure 3); thus, the neural network is based on the noise-reduced vectors ("cleaned training values");

"a noise reduction module being receptive of the test signal and being capable of applying the noise reduction technique to the test signal to produce cleaned test values" – during use of the speech recognition block (I), after the to-be-described training, the noisy speech signals are supplied to the preprocessing installation PP1 by the microphone; then the noisy speech signals are supplied to the neural network N, which performs a noise reduction (column 3, lines 25 to 45: Figures 1 and 3);

"a decoder, receptive of features of the cleaned test values and capable of accessing the pattern recognition model to identify patterns in the test signal based on the cleaned test values" – during speech recognition, following noise reduction, speech recognition is performed on noise-reduced speech vectors by speech recognition block (I); the speech recognition block (I) uses a standard word recognizer (column 3, lines 13 to 29: Figures 1 and 3).

Regarding claim 10, *Trompf ('968)* discloses a speech recognition process, where a noisy speech signal ("a test signal") is received, a neural network N performs noise reduction on the noisy speech signal ("to produce pseudo-clean test data"), and speech recognition block (I) performs speech recognition on the noise reduced noisy speech signal (column 3, lines 10 to 47: Figures 1 and 3).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 2 to 9, 12 to 16, and 18 to 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Trompf ('968)* in view of *Sameti et al. ("HMM-Based Strategies for Enhancement of Speech Signals Embedded in Nonstationary Noise").*

Concerning claim 2, *Trompf ('968)* omits applying a plurality of noise reduction techniques. However, *Sameti et al.* discloses several speech enhancement methods,

including spectral subtraction and HMM-based enhancement methods. (Pages 446 to 449: II. Speech Enhancement Methods) It is stated that the noise adaptation algorithm is adapted to handle arbitrary types of corrupting noise by selecting a noise model, and switching to a model representing a new noise type if required. *Sameti et al.* suggests the method of noise model selection can successfully cope with noise level variation as well as different noise types, and keeps the noise model sufficiently compact so that excessive computation in enhancement is avoided. (Pages 449 to 450: III. Noise Adaptation Algorithm) In particular, MAP and AMAP noise reduction algorithms were only used for white noise, while spectral subtraction and MMSE methods were used to handle all three types of noise. (Page 552: Left Column, Last Paragraph) It would have been obvious to utilize a plurality of noise reduction techniques by selecting among noise models as taught by *Sameti et al.* in the noise reduction training method as disclosed by *Trompf ('968)* for the purpose of coping with noise level variation and avoiding excessive computation.

Concerning claims 3 to 5, 14 to 16, and 18 to 20, *Sameti et al.* discloses a speech enhancement method adapted to handle arbitrary types of corrupting noise by selecting a noise model, and switching to a model representing a new noise type if required. (Pages 449 to 450: III. Noise Adaptation Algorithm) In particular, MAP and AMAP noise reduction algorithms were only used for white noise, while spectral subtraction and MMSE method were used to handle three types of noise, i.e. white noise, helicopter noise, and recorded multi-talker party noise. (Page 552: Left Column, Last Paragraph) Thus, spectral subtraction can be applied to all the sets of noise, while

MAP and AMAP algorithms are only applied to white noise, but not helicopter noise or multi-talker party noise. *Sameti et al.* suggests the method of noise model selection can successfully cope with noise level variation as well as different noise types, and keeps the noise model sufficiently compact so that excessive computation in enhancement is avoided. (Pages 449 to 450: III. Noise Adaptation Algorithm) It would have been obvious to utilize a plurality of noise reduction techniques by selecting among noise models as taught by *Sameti et al.* in the noise reduction training method as disclosed by *Trompf ('968)* for the purpose of coping with noise level variation and avoiding excessive computation.

Concerning claims 6 to 9 and 21, *Sameti et al.* discloses a noise enhancement method that compares each noisy signal ("receiving and sampling noise in the test signal"), calculates a likelihood for the received noisy signal and each pretrained noise HMM ("identifying a separate probability"), and selects a noise model based on the likelihood ("selecting a probability"). (Page 552: Left Column: First Paragraph: Figure 6) Then, based on the type of noise identified ("identifying the set of noisy training data"), MAP and AMAP algorithms are only applied for white noise, but spectral subtraction and MMSE methods are applied for all types of noise ("applying the noise reduction technique"). (Page 552: Left Column: Last Paragraph)

Concerning claims 12 and 13, *Sameti et al.* suggests noise enhancement involving recorded multi-talker party noise. (Page 552: Left Column, Last Paragraph) *Trompf ('968)* discloses separately supplying and summing speech-free noise signals from the microphone M and noise–free speech signals from memory S (column 4, lines

24 to 28: Figure 3). Recorded speech and noise samples are an art-recognized alternative to live speech and noise samples. Thus, it would have been obvious to one having ordinary skill in the art to supply the summed speech-free noise signals and noise-free speech signals of *Trompf ('968)* as recorded noise and speech, respectively, because recorded samples are art recognized alternatives to live samples as suggested by *Sameti et al.*

Concerning claims 22 to 26, *Sameti et al.* discloses a noise enhancement method that compares each noisy signal. (Page 552: Left Column: First Paragraph: Figure 6) Then, based on the type of noise identified, MAP and AMAP algorithms are only applied for white noise, but spectral subtraction and MMSE methods are applied for all types of noise. (Page 552: Left Column: Last Paragraph) The selected noise models are "a pattern recognition model" and "a second pattern recognition model", as applied to the claim limitations discussed above.

Concerning claims 27 to 29, *Sameti et al.* discloses speech recognition is performed to recognize features, phonemes ("a sub-word acoustic unit"), or words. (Page 446, Right Column) Implicitly, a standard speech recognizer recognizes a series of words ("a string of words") from individual features, phonemes, and words.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Martin Lerner whose telephone number is (703) 308-

9064. The examiner can normally be reached on 8:30 AM to 6:00 PM Monday to Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richemond Dorvil can be reached on (703) 305-9645. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ML
6/21/04

Martin Lerner

Martin Lerner
Examiner
Group Art Unit 2654